Janet Napolitano
Governor

ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

1110 West Washington Street • Phoenix, Arizona 85007
(602) 771-2300 • www.azdeq.gov

Stephen A. Owens
Director

D R A F T

Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM_{10}) Concentration Event in the Nogales, Arizona Area on May 18, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) operates monitors at the Post Office in Nogales, Arizona for PM_{10} and $PM_{2.5}$ and at the Fire Station in Nogales, Sonora for PM_{10}. Federal Reference Method (FRM) filter based samples are collected at both locations. Two Beta-Attenuation Monitor Systems (BAMS) collect hourly PM_{10} and $PM_{2.5}$ concentration data at the Post Office site.

During the evening of May 18, 2008, a strong night-time temperature inversion set up in the Nogales area. With no significant ventilating winds available to break up the surface inversion, the inversion intensified and set up a drainage flow from the higher terrain to the south in Mexico through Nogales, Sonora and into Nogales, Arizona.

The event brought significant elevated ambient concentrations of PM_{10} that exceeded the National Ambient Air Quality Standards (NAAQS) at the ADEQ Nogales Post Office monitor (BAMS). The fact that ambient concentrations exceed the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event "affects air quality." Preliminary indications were that emissions from sources in Mexico, which are not subject to control by the Arizona SIP, may have contributed to the event.

A PM_{10} State Implementation Plan (SIP) exists for Nogales, Arizona. All appropriate SIP control measures were in place during the event demonstrating, per 40 CFR 50.1(j), that the event "is not reasonably controllable or preventable," if in fact emissions from Mexico caused the exceedance.

Elevated PM_{10} concentrations were measured in the Nogales area. The table below shows the key PM monitor readings for the monitors examined in this report. The $PM_{2.5}$ data were included in this analysis for informational purposes only. These data are particularly useful for the Event Contribution Analysis contained in Figure 1 as well as identifying the type of PM that may have been present, as discussed in section 2.

Monitor (Operator/Type)	AQS ID*	24-hr Avg PM_{10} or $PM_{2.5}$	1-hr Max PM_{10} or $PM_{2.5}$	Time of Max 1-hr	Flag**
NOGALES AREA					
Nogales AZ Post Office PM_{10} (ADEQ/BAM)	**04-023-0004 (3)**	**169**	**666**	**2100**	**RL**
Nogales AZ Post Office $PM_{2.5}$ (ADEQ/BAM)	**04-023-0004 (3)**	**20.8**	**66**	**2100**	None

* EPA Air Quality System Identification Number
** 24-hr PM_{10} concentration influenced by exceptional event (international transport) to be flagged.
Type Abbreviations: BAM – Beta-Attenuation Mass Monitor (Continuous monitor)

The preliminary findings from this analysis were presented at a stakeholders meeting on November 19, 2008, in Phoenix, Arizona. Following this stakeholders meeting, ADEQ will finalize this demonstration and solicit public comment on the final demonstration. Any comments that are received will be forwarded to EPA with this demonstration pursuant to 40 CFR 50.14(c)(3)(i).

NWS-Tucson INT Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	77	10		13	13	SE
2	73	10		6	6	S
3	71	10		6	6	E
4	66	10		6	6	S
5	68	10		6	6	SE
6	69	10		7	7	SE
7	71	10		7	7	S
8	78	10		8	8	SE
9	81	10		3	3	S
10	87	10		0	0	N
11	91	10		5	5	*VR
12	93	10		8	8	NE
1	94	10		7	7	NE
2	96	10		7	7	*VR
3	95	10		5	5	*VR
4	95	10		7	16	*VR
5	96	10		9	16	NW
6	96	10		11	11	NW
7	93	10		10	10	NW
8	90	10		8	8	NW
9	86	10		0	0	N
10	83	10		0	0	N
11	80	10		6	6	*VR
12	77	10		7	7	S

NWS-Nogales INT Airport

Hr	T(F)	VR	Dust	Spd	Gust	Dir
1	71	10		3	3	*VR
2	66	10		3	3	E
3	61	10		5	5	NE
4	62	10		6	6	NE
5	59	10		0	0	N
6	56	10		3	3	NE
7	66	10		0	0	N
8	71	10		0	0	N
9	77	10		0	0	N
10	82	10		5	5	*VR
11	87	10		8	18	N
12	89	10		7	7	N
1	90	10		10	10	N
2	91	10		6	21	E
3	90	10		6	6	*VR
4	92	10		8	18	NE
5	89	10		10	10	NE
6	89	10		7	7	*VR
7	86	10		5	5	N
8	80	10		6	6	NE
9	74	10		6	6	E
10	72	10		0	0	N
11	71	10		0	0	N
12	66	10		0	0	N

ADEQ-Nogales P.O.

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	N/A	N/A	-	1	1	S
2	N/A	N/A	-	2	2	S
3	N/A	N/A	-	0	0	N
4	N/A	N/A	-	0	0	NE
5	N/A	N/A	-	2	2	S
6	N/A	N/A	-	1	1	S
7	N/A	N/A	-	1	1	SW
8	N/A	N/A	-	2	2	NE
9	N/A	N/A	-	3	3	N
10	N/A	N/A	-	3	3	E
11	N/A	N/A	-	4	4	N
12	N/A	N/A	-	7	7	N
1	N/A	N/A	-	8	8	N
2	N/A	N/A	-	7	7	N
3	N/A	N/A	-	6	6	N
4	N/A	N/A	-	7	7	N
5	N/A	N/A	-	6	6	N
6	N/A	N/A	-	7	7	NE
7	N/A	N/A	-	7	7	N
8	N/A	N/A	-	3	3	NE
9	N/A	N/A	-	2	2	SE
10	N/A	N/A	-	2	2	S
11	N/A	N/A	-	2	2	S
12	N/A	N/A	-	2	2	SW

Event Contrib. Analysis

Hourly PM_{10} Conc. ($\mu g/m^3$)

MONITORS:

1-Nogales PM10
2-Nogales PM2.5

24-Hr. Avg PM_{10}

Monitor:	with Event	w/o Event
1-Nogale	169	103
2-Nogale	20.8	14.0

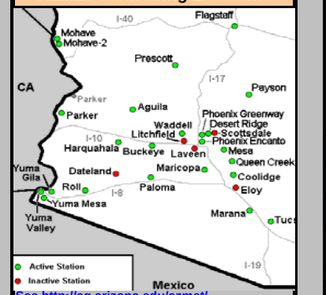
> NAAQS | < NAAQS

Pink=Event Contrib.

Conclusion: As shown above, the PM_{10} concentration would have been below the NAAQS "BUT FOR" the event contribution (hours highlighted in pink).

Hr	1	2
1	222	28
2	432	45
3	251	25
4	222	30
5	247	33
6	141	19
7	168	22
8	102	9
9	52	10
10	27	9
11	21	6
12	20	3
1	22	2
2	21	6
3	20	4
4	10	3
5	21	6
6	22	8
7	23	6
8	25	6
9	485	51
10	666	66
11	486	57
12	357	46

AZMET Monitoring Locations



See http://ag.arizona.edu/azmet/

wnd @3m agl / Dir corrected to true north

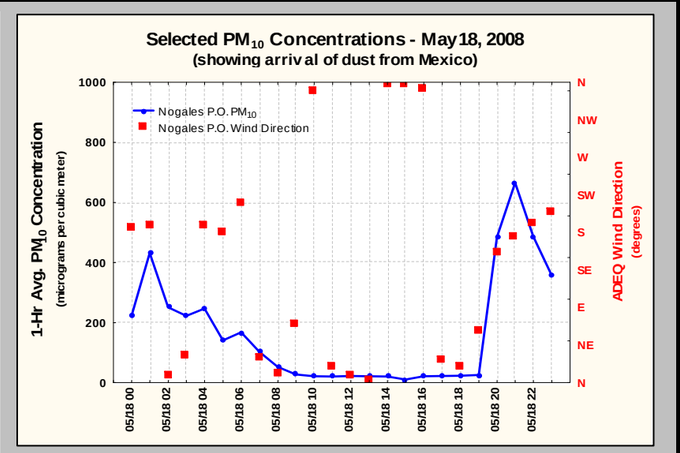
HIGHLIGHTING	Col.	Parameter
Max Wind	T(F)	Temp. (Deg. F.)
> 15 mph	RH	Rel Humidity %
>25 mph	Rn	Rain (Inches/hr)
HR - Time (End)	Spd	Avg Speed mph
A.M.	Max	Max Speed mph
P.M.	Dir	Wind Dir. (from)

Figure 1. Key Data for Event of May 18, 2008

PHX WINDS	KEY	PM10 PLOT
CEN. AZ WINDS		SAT IMAGES
SO AZ WINDS		PHX VIS. CAMERAS

SUMMARY OF EVENT

Stable atmospheric conditions allowed for a nocturnal drainage flow to set up during the evening hours of 05/18. Light, southerly winds transported coarse particulate matter (PM_{10}) from Sonora, Nogales into Nogales, AZ.



PARKER

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	74	38	-	3	6	W
2	74	35	-	3	5	S
3	73	36	-	4	8	S
4	68	49	-	4	7	NE
5	64	58	-	4	8	N
6	62	68	-	2	5	N
7	67	58	-	1	3	NE
8	77	40	-	2	4	N
9	82	30	-	1	4	NW
10	89	22	-	1	4	N
11	94	18	-	2	5	NW
12	99	10	-	2	5	S
1	101	11	-	3	7	W
2	104	10	-	5	9	S
3	106	9	-	6	9	S
4	107	10	-	6	9	S
5	106	12	-	7	9	S
6	104	16	-	6	7	S
7	100	20	-	5	7	S
8	90	28	-	4	6	S
9	82	39	-	6	7	S
10	81	32	-	6	7	S
11	82	25	-	7	11	S
12	82	22	-	10	13	S

BUCKEYE

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	74	25	-	4	6	NE
2	71	31	-	3	6	NE
3	68	42	-	4	6	E
4	67	45	-	4	6	E
5	68	44	-	4	6	E
6	69	38	-	3	5	E
7	67	43	-	1	5	W
8	77	29	-	2	9	SE
9	87	20	-	7	12	E
10	89	22	-	7	11	SE
11	91	22	-	7	11	SE
12	94	23	-	5	10	SE
1	97	19	-	4	6	SE
2	100	12	-	3	7	S
3	102	13	-	3	7	S
4	102	17	-	4	6	SE
5	101	19	-	4	7	SE
6	99	22	-	4	7	S
7	95	24	-	3	6	S
8	90	24	-	1	3	S
9	86	25	-	0	1	SE
10	85	18	-	2	5	NW
11	80	21	-	2	5	N
12	82	17	-	2	4	N

MARICOPA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	73	28	-	4	7	S
2	71	31	-	4	6	S
3	72	25	-	5	7	S
4	73	26	-	6	9	S
5	69	32	-	4	7	S
6	63	44	-	4	6	NW
7	68	39	-	1	6	NW
8	74	32	-	2	4	N
9	82	25	-	3	5	NW
10	88	20	-	2	5	N
11	93	15	-	2	6	NE
12	96	13	-	3	7	N
1	98	11	-	4	10	W
2	100	10	-	5	11	N
3	101	8	-	4	9	N
4	103	8	-	3	10	N
5	103	7	-	3	8	N
6	103	7	-	3	9	W
7	99	10	-	4	6	S
8	92	16	-	3	5	S
9	85	22	-	3	5	SW
10	81	28	-	3	5	S
11	79	27	-	4	6	S
12	78	22	-	4	7	S

Historical Distribution

5-Yr. Dist. of Values ($\mu g/m^3$)

MONITORS: 1-NOGALES POST O

Column Index

Yr - All Data (5-Yrs)
Sea - Data for Spring season only (5-Yrs)

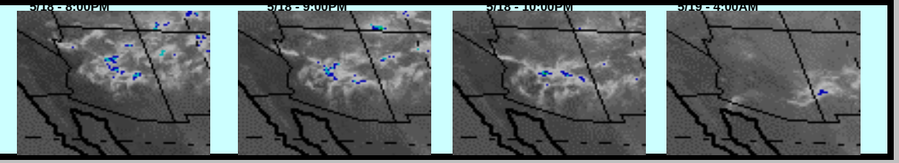
Cum. Freq.	Mon 1 Yr	Mon 1 Sea
Min	4	7
0.5%	8	8
1.0%	8	9
2.5%	13	15
5%	17	18
10%	22	25
25%	35	39
50%	56	56
75%	96	83
90%	146	109
95%	180	128
97.5%	213	139
99.0%	244	164
99.5%	291	174
Max	351	179
Flagged Value	169	

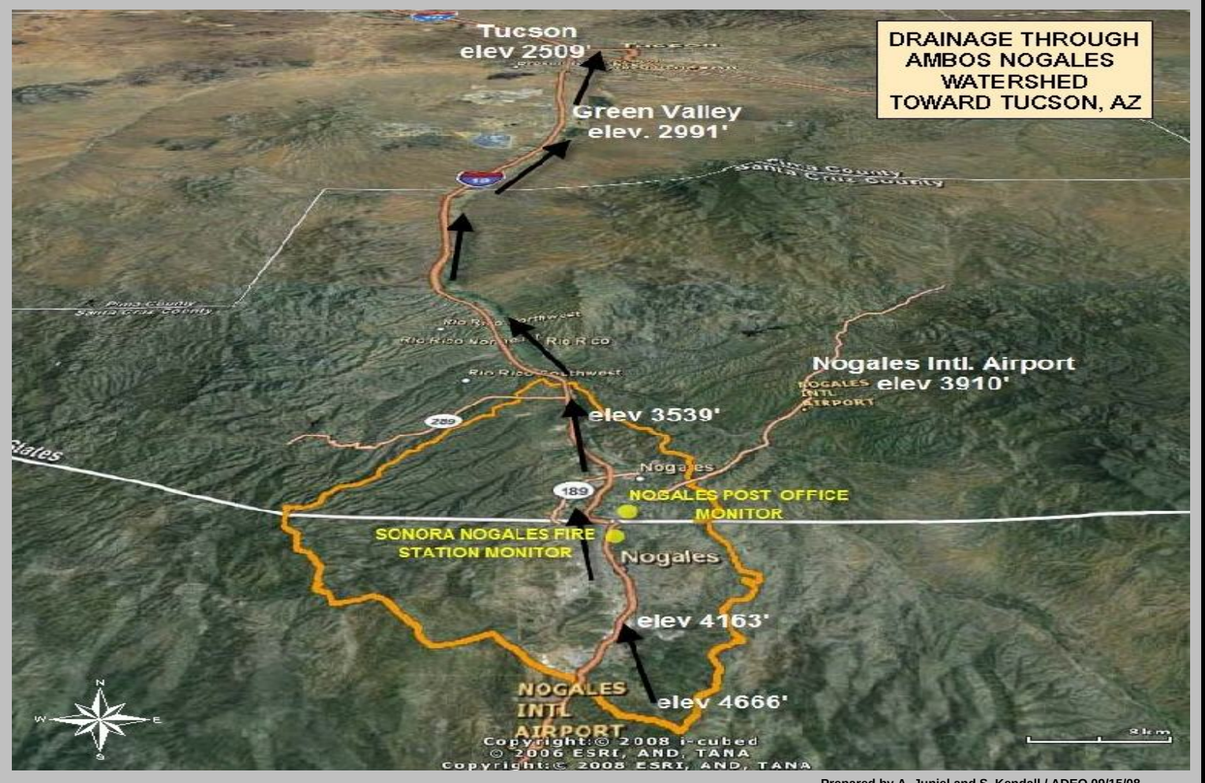
Conclusion: Flagged Value is exceptional in nature (ie greater than 95% of all data)

GOES-West Satellite

5/18 - 2:00PM

Image not available





YUMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	68	66	-	2	6	SE
2	67	65	-	3	7	E
3	65	69	-	2	5	NE
4	66	63	-	2	4	NE
5	65	62	-	1	4	NE
6	64	62	-	1	3	NE
7	70	47	-	1	3	NE
8	80	38	-	2	5	NE
9	87	27	-	2	6	NE
10	91	24	-	2	4	SW
11	97	21	-	3	6	SW
12	102	14	-	5	8	SW
1	104	15	-	7	12	SW
2	104	16	-	8	12	S
3	104	17	-	8	12	SW
4	105	17	-	8	12	S
5	103	19	-	8	11	SW
6	100	25	-	6	10	SW
7	95	31	-	5	8	SW
8	86	41	-	4	6	SW
9	80	44	-	3	6	SW
10	79	39	-	3	6	W
11	76	43	-	2	5	S
12	77	37	-	3	8	NE

PALOMA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	71	44	-	4	7	SW
2	71	33	-	2	5	SE
3	66	55	-	3	4	E
4	63	61	-	3	6	N
5	62	66	-	2	4	NE
6	62	62	-	2	4	NE
7	68	54	-	2	4	E
8	76	43	-	3	5	E
9	82	42	-	3	4	NE
10	89	30	-	3	5	NE
11	94	22	-	3	4	E
12	97	18	-	2	6	NE
1	101	12	-	3	9	NW
2	103	10	-	4	9	NW
3	104	11	-	4	8	NW
4	105	10	-	3	7	NW
5	107	9	-	1	5	W
6	105	11	-	2	4	SW
7	99	21	-	2	3	S
8	93	23	-	2	4	SE
9	89	21	-	3	5	S
10	81	33	-	4	7	SW
11	79	31	-	4	6	SW
12	77	30	-	4	8	SW

MARANA

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	72	28	-	5	8	E
2	71	30	-	6	8	SE
3	71	30	-	7	11	SE
4	68	33	-	6	9	SE
5	67	37	-	6	9	SE
6	67	35	-	4	8	SE
7	70	33	-	7	11	SE
8	76	27	-	7	12	SE
9	82	22	-	7	12	SE
10	88	17	-	7	11	SE
11	92	13	-	3	8	SE
12	93	12	-	4	11	NW
1	96	11	-	5	15	W
2	97	11	-	7	14	NW
3	98	10	-	7	15	NW
4	99	10	-	9	16	NW
5	98	9	-	9	16	NW
6	97	9	-	9	15	NW
7	93	11	-	6	10	NW
8	85	15	-	4	7	NW
9	81	15	-	0	2	N
10	79	17	-	1	3	SE
11	76	18	-	3	5	SE
12	73	21	-	2	4	E

TUCSON

Hr	T(F)	RH	Rn	Spd	Max	Dir
1	66	44	-	2	4	E
2	65	42	-	1	3	E
3	64	42	-	2	3	E
4	65	39	-	2	4	SE
5	65	41	-	3	5	E
6	64	42	-	3	6	E
7	68	40	-	1	3	E
8	75	31	-	3	6	E
9	81	24	-	2	7	E
10	85	20	-	3	7	E
11	88	17	-	4	9	W
12	90	15	-	4	9	NE
1	92	14	-	4	11	W
2	94	12	-	6	16	W
3	96	11	-	8	18	NW
4	96	11	-	8	18	NW
5	97	10	-	10	18	NW
6	96	10	-	11	20	W
7	94	10	-	10	18	NW
8	91	10	-	7	14	NW
9	87	11	-	3	6	NW
10	82	15	-	2	4	W
11	75	21	-	1	3	S
12	71	25	-	2	4	E

Prepared by A. Juniel and S. Kendall / ADEQ 09/15/08

Assessment Under the Technical Criteria Document (TCD)

1. Properly qualify and validate the air quality measurement to be flagged. As this was not a filter sampling date (1-in-6 run day), only data from the continuous analyzers were examined. The air quality monitoring data were reviewed by ADEQ, the agency responsible for operation of the monitor. All hourly PM_{10} readings from the Nogales BAMS monitor were found to be valid for May 18th. No specific local sources were reported as significantly contributing to the air quality episode.

2. Review suspected contributing sources. The event began on the evening of May 18th. There was not a significant fraction of $PM_{2.5}$ measured during this episode. This is typical for the arid southwest, except when smoke from smoldering fires can be a significant source of $PM_{2.5}$. Lack of any significant transport winds would indicate that the emissions are probably from nearby the monitor. The plot of hourly PM_{10} concentration data in the upper right corner of Figure 1, in conjunction with the wind direction data, confirms the identical timing of the transport from the south across the border when the elevated PM concentrations began. It is clear from the $PM_{2.5}$ data presented for informational purposes in the Event Contribution Analysis table that there was not an overwhelming contribution from wood fire smoke that had been seen in other events. This event appears to have significantly more non-specific course dust, probably from dirt roads, than the January 1, 2008 episode, where nearly half of the PM_{10} concentration could be attributed to fine particulate matter, most likely in the form of smoke.

3. Examine all air quality monitoring information. Data from all monitors in the network were reviewed. Monitors from the Nogales area are summarized in the table in the Background section of this assessment. Pursuant to 40 CFR 50.14(c)(3)(iii)(C), the "Historical Distribution" Table in Figure 1 has been included to demonstrate that the event is associated with measured concentrations in excess of normal historical fluctuations, including background (e.g., concentrations greater than the 95th percentile).

4. Examine the meteorological conditions before and during the event. Figure 1 includes a map showing the terrain and drainage patterns of the Nogales area. Cold air forming in the mountains south of the border will flow northward into the Santa Cruz River Drainage Basin. National Weather Service data from the Nogales Airport, northeast of the city, showed calm to light and variable winds in the evening hours from the east or south. The data from ADEQ's wind monitor are also included in Figure 1. At the Post Office, winds shifted from north / northeast to south at approximately 8:00 p.m. and remained very light. It was at this time when PM concentrations significantly increased. PM_{10} (as well as $PM_{2.5}$) concentrations remained elevated throughout the remainder of the evening on May 18th as light winds of approximately 2 miles per hour continued out of the south. It appears the source is coming from Mexico, since there are no sources in the United States between the monitor and the border.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM_{10} concentrations in the Nogales, Arizona area can be attributed to dust emissions from sources south of Nogales, Arizona in Nogales, Sonora. The data available for this analysis do not allow for development of a source specific emission allocation. The hourly concentration data do not show any significant source other than the drainage dust associated with the event.

6. Estimation of Contribution from Source or Event. The primary source appears to be drainage dust from Mexico for which there is no effective or efficient method to estimate the relative contributions from specific sources. The demonstration analysis contained in this report establishes the linkage between the measurements to be flagged and the event, thus satisfying the requirement in 40 CFR 50.14(c)(3)(iii)(B). Pursuant to 40 CFR 50.14(c)(3)(iii)(D), the "Event Contrib. Analysis" Table in Figure 1 has been included to demonstrate that there would have been no exceedances or violations but for the event (e.g., the contribution during the event overwhelmed the 24-hour average).

7. Determination that a Natural or Exceptional Event Contributed To an Exceedance. Based on this analysis, the event satisfies the requirement in 40 CFR 50.1(j) that the elevated concentrations at the Nogales Post Office monitor were attributed to an exceptional event caused by international transport of emissions into the United States.

Conclusion

International transport of emissions. The elevated PM_{10} event on May 18, 2008, in Nogales, Arizona was the result of emissions from Mexico which were transported into the United States in a slow moving drainage flow originating in the mountains south of Nogales, Sonora. The fact that all appropriate SIP control measures were in place and emissions from international transport caused the exceedance demonstrates, per 40 CFR 50.1(j), that the event "is not reasonably controllable or preventable." The "other" flag (RL) was applied to the PM_{10} measurements as the monitor would have been below the NAAQS but for the contribution of the event.